NAVWEPS 16-30URM75-501

Handbook
Operating Instructions

GENERATOR, SWEEP
AN/URM-75

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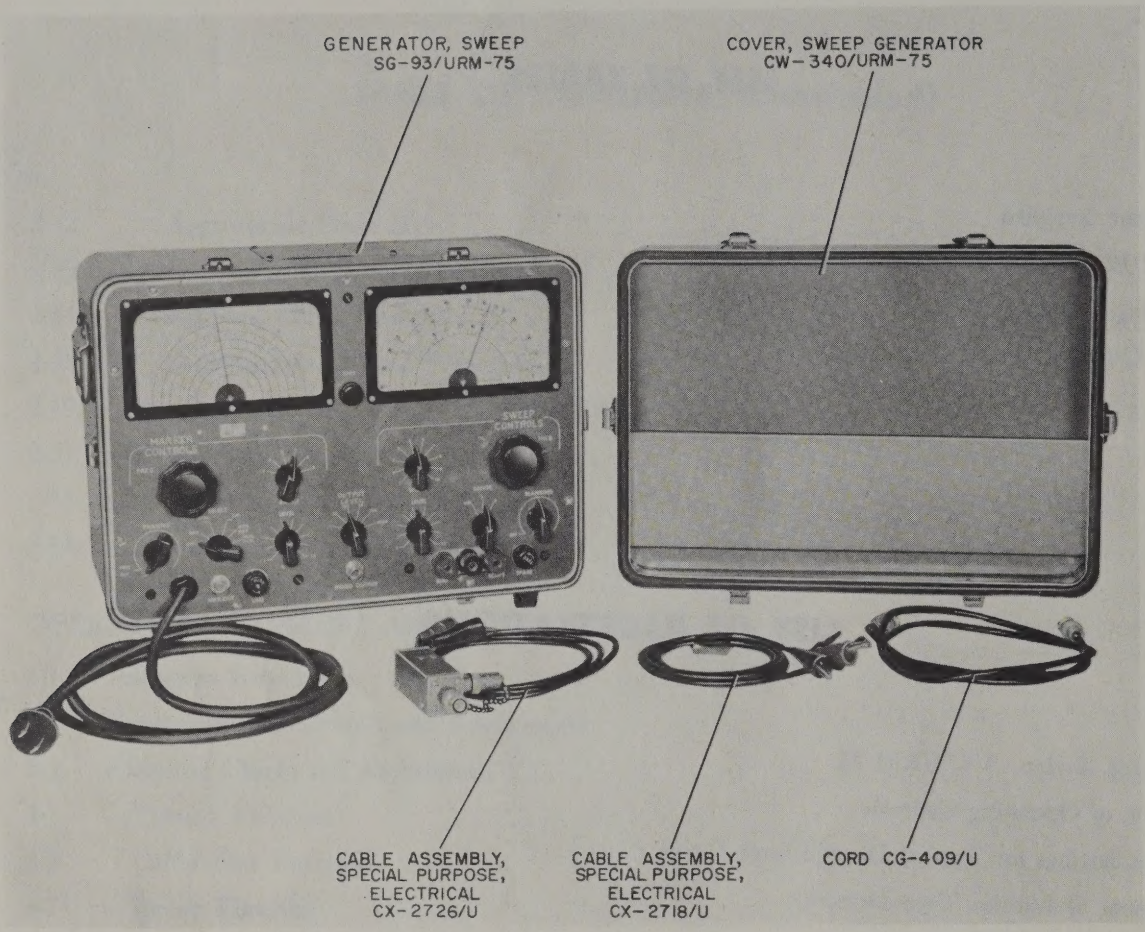

Figure 1-1. Generator, Sweep, AN/URM-75

SECTION I
GENERAL DESCRIPTION

1-1. INTRODUCTION.

1-2. PURPOSE OF HANDBOOK.

1-3. The purpose of this handbook is to provide the operator of Generator, Sweep, AN/URM-75, with the necessary instructions for operating the equipment efficiently and effectively. The instructions include an explanation of the purpose and the general principles of operation of the equipment, correct operating procedures to be employed, operating checks and adjustments to be made by the operator to determine whether the equipment operation is normal, and emergency operation and repair procedures that can be performed by the operator in the event of equipment failure.

1-4. PURPOSE OF EQUIPMENT.

1-5. Generator, Sweep, AN/URM-75, is a versatile, precision, test instrument capable of providing many services. It has been specifically designed to provide the signals necessary for aligning and checking Radio Receiving Set AN/ARR-26, but it may also be used to perform similar service for other receivers which have bandpass characteristics that lie within its frequency range. The generator supplies signals for observing frequency-response, relative-gain, and bandpass characteristics of r-f, i-f, and video stages; for aligning r-f and i-f circuits; for checking and adjusting discriminators; and for determining relative receiver sensitivity. Familiarity with the equipment will doubtless suggest to the operator additional purposes for which the generator can be used.

1-6. GENERAL PRINCIPLES OF OPERATION.

1-7. Basically, Generator, Sweep, AN/URM-75, consists of an FM sweep oscillator, a marker oscillator, a crystal oscillator, and an audio oscillator. Two-front-panel output jacks, the MKR. OUT jack and the MIXED OUTPUT jack, are provided for making the generated signals readily available for test and alignment purposes. With the exception of the sweep signal, which is applied only to the MIXED OUTPUT jack, all signals are available at both output connections. In addition, all signals except the 600-cycle audio signal are available independently. The 600-cycle audio signal is used solely for modulating the marker and crystal outputs.

1-8. The FM sweep oscillator is tunable over a frequency range of 50 to 220 mc. By means of a variable capacitor driven by an oscillating motor, the oscillator can be operated to provide a periodic maximum sweep deviation bandwidth of approximately 10% of the center frequency on band B and 12 mc on band A.

1-9, In conjunction with a sweep-converter stage, the sweep oscillator produces a sweep signal that is variable in frequency from 5 to 220 mc. This range is covered in two bands, band A and band B. On band A, the sweep-oscillator signal is arranged to beat against a 116.5-mc signal from a fixed-frequency oscillator of the converter stage, to produce another signal that is variable in frequency from 5 to 50 mc. This sweep signal is available at the MIXED OUTPUT jack. On band B, the sweep converter is disabled, and the sweep oscillator operates alone to produce a sweep signal that is variable in frequency from 50 to 220 mc. This sweep signal is also available at the MIXED OUTPUT jack. The sweep signal is available alone or in combination with a marker signal.

1-10. The marker oscillator operates over a frequency range of 4 to 220 mc, which is covered in six bands. The marker signal is available, either modulated or unmodulated, at each output jack. By means of this signal, it is possible to determine the exact frequency at any point along a response curve produced by the sweep signal.

1-11. The crystal oscillator is normally operated at a fundamental frequency of 10 mc. However, the circuit design and constants are such that by the insertion of the appropriate crystal, oscillations will occur at frequencies from 4 to 15 mc. The crystal-oscillator signal is available, either modulated or unmodulated, at each output jack. This signal provides a means of correctly calibrating the marker oscillator and of calibrating other external equipments.

1-12. The audio oscillator generates a signal with a fundamental frequency of 600 cycles, which may be used to modulate the marker output or the crystal-oscillator output. The audio signal is not available as an independent output.

1-13. Incorporated within the FM signal generator is a blanking circuit consisting of one-half of a twin triode. The output of this blanking triode is a 60-cycle sine wave. The positive half-cycle of this signal is eliminated, and the negative half-cycle may be applied to the grid of the FM sweep oscillator to cut off this stage for the duration of the negative half-cycle. Thus, the FM sweep oscillator will produce pulses of energy occurring at a 60-cycle rate. Use of this feature is optional with the operator.

1-14. Signals are applied to the MIXED OUTPUT jack through a mixer-output stage. This stage provides a means of combining signals and of controlling the amplitude of the output signal.

1-15. EQUIPMENT SUPPLIED.

1-16. The equipment supplied as part of Generator, Sweep AN/URM-75 is illustrated and identified in figure 1-1. Table 1-1 presents a summary of the equipment supplied.

TABLE 1-1.

EQUIPMENT SUPPLIED

Item	*Quantity*	*Description*
1	1	Generator, Sweep AN/URM-75
2	1	Cord CG-409/U(4′ 1″)
3	1	Cable Assembly, Special Purpose, Electrical CX-2718/U(4′ 3″)
4	1	Cable Assembly, Special Purpose, Electrical CX-2726/U(4′ 4″)
5	1	Cover, Sweep Generator, CW-340/URM-75

1-17. EQUIPMENT REQUIRED BUT NOT SUPPLIED.

1-18. Although Generator, Sweep, AN/URM-75, is in itself a complete equipment, other equipment will be required for performing the various testing and aligning operations for which the generator was intended. The exact nature of the additional equipment will be determined by the particular operation being performed. The procedures for the various testing and aligning operations are given in Section II.

1-19. DESCRIPTION OF EQUIPMENT.

1-20. Generator, Sweep, AN/URM-75, consists of a single component in a case 15 inches wide, 10 inches deep, and 10 inches high. (See figure 1-1.) A cover fastens over the front of the component to make the equipment splashproof. The necessary cables and a detector box are stored under the cover when the equipment is not in use. Two handles are provided, one on each side of the case, for carrying the equipment. All connectors and controls are located on the front panel. Also on the front panel are two illuminated dial scales, each covered with a lucite window. The a-c input power cable is permanently attached near the lower left-hand corner of the panel. The line fuse and a spare fuse are accessible from the front of the equipment. The controls, connectors, and dial scales are located for convenience and efficient operation.

1-21. GENERAL ELECTRICAL AND MECHANICAL CHARACTERISTICS.

1-22. The general electrical and mechanical characteristics of Generator, Sweep, AN/URM-75, are listed in Table 1-2.

TABLE 1-2.

GENERAL ELECTRICAL AND MECHANICAL CHARACTERISTICS

Sweep range Band A Band B	 5 to 50 mc (beat frequency output) 50 to 220 mc (fundamental output)
Sweep deviation	Up to 12 mc, variable by use of SWEEP WIDTH control.
Sweep rate	60 cycles, fixed
Marker range Band A Band B Band C Band D Band E Band F	 4 to 8 mc 8 to 16 mc 15 to 32 mc 30 to 60 mc 52 to 105 mc 96 to 220 mc If desired, the marker signal may be modulated with a 600-cycle audio signal.
Calibration	Crystal oscillator provided for calibration of selected points. Any crystal with a frequency within the range of 4 to 15 mc can be installed, and harmonic calibrations obtained. A 10-mc crystal is supplied with the generator, and if desired, the output may be modulated by a 600-cycle audio signal.
Bias	0 to —12 volts, dc, available at BIAS jack, variable by use of BIAS control.
Input voltage	110/120 volts, 60 cycles, ac
Power consumption	50 watts
Tube complement	Five 6BQ7 twin triodes One 12AU7 twin triode One 6BJ6 pentode One 7Z4 diode

TABLE 1-2 (Continued)

Fuse complement	One 1-amp (input power) One spare
Dial scales	Illuminated marker scale and sweep scale on front panel. Each scale has 2½ in. x 6 in. lucite window.
Connections and outputs	Permanently attached a-c power input cable. Oscilloscope connections available between ground jack and SCOPE jack. Bias of 0 to —12 volts, dc, available at BIAS jack. Marker signal available at MKR. OUT jack. Marker signal, sweep signal, or combination of both signals available at MIXED OUTPUT jack.
Operating temperature range	0° to +45°C (+32°F to +113°F)

TABLE 1-2 (Continued)

Operating altitude	Up to 10,000 feet
Equipment life	1000 hours, under normal operating conditions, either intermittent or continuous operation.
Over-all dimensions	With cover attached 15 in. high x 10 in. deep x 10 in. wide.
Weight	30 lb, approx
Housing	Gray Hammertone finish. Splashproof when cover is in place.
Packing	Standard commercial packing.
Transportability	Two handles provided for ease of carrying.

SECTION II
OPERATING PROCEDURES

2-1. LOCATION AND FUNCTION OF OPERATING CONTROLS.

2-2. All operating controls for Generator, Sweep, AN/URM-75, are located on the front panel. These controls are shown in figure 2-1. Table 2-1 lists the controls and describes their functions.

TABLE 2-1.

OPERATING CONTROLS

Name	*Function*
PHASING	Knob-controlled switch and potentiometer. In PWR. OFF position, disconnects primary a-c voltage from equipment. When control is rotated clockwise from PWR. OFF position, applies primary a-c power to equipment. Further rotation varies phase of 60-cycle a-c voltage available at SCOPE jack for use as sweep-trace voltage for an external oscilloscope.
SWEEP RANGE	Knob-controlled, three-position rotary switch. Selects range of frequencies over which FM sweep oscillator can operate. In OFF position, FM sweep oscillator is inoperative. In A position, FM sweep oscillator produces sweep signal in 0 to 50-mc band. In B position, FM sweep oscillator produces sweep signal in 50 to 220-mc band.
SWEEP FREQ.	Knob-controlled variable inductor. Adjusts center frequency of FM sweep oscillator.
SWEEP WIDTH	Knob-controlled potentiometer. Adjusts amount of sweep-signal deviation from 0 cycles to 12 mc.
SWEEP LEVEL	Knob-controlled potentiometer. Adjusts amplitude of sweep signal.

TABLE 2-1 (Continued)

Name	*Function*
MARKER SELECT	Knob-controlled, six-position rotary switch. Selects function of marker oscillator, crystal oscillator, and audio oscillator. In OFF position, marker oscillator, crystal oscillator, and audio oscillator are inoperative. In MKR. position, crystal oscillator and audio oscillator are inoperative, and marker oscillator is operative to produce unmodulated r-f signal, which is available at both the MKR. OUT jack and the MIXED OUTPUT jack for marker purposes or for general test and alignment purposes. In XTAL. position, marker oscillator and audio oscillator are inoperative, and crystal oscillator is operative to produce unmodulated r-f signal which is available at each output jack for calibration of external equipment. In CAL. position, audio oscillator is inoperative, and both marker oscillator and crystal oscillator are operative to produce beat signal, which is available at each output jack for calibration of marker oscillator. In MOD. MKR. position, crystal oscillator is inoperative, and both marker oscillator and audio oscillator are operative to produce modulated r-f signal, which is available at each output jack for general test and alignment purposes. In MOD. XTAL. position, marker oscillator is inoperative, and both crystal oscillator and audio oscillator are operative to produce modulated r-f signal, which is available at each output jack for calibration of external equipment.

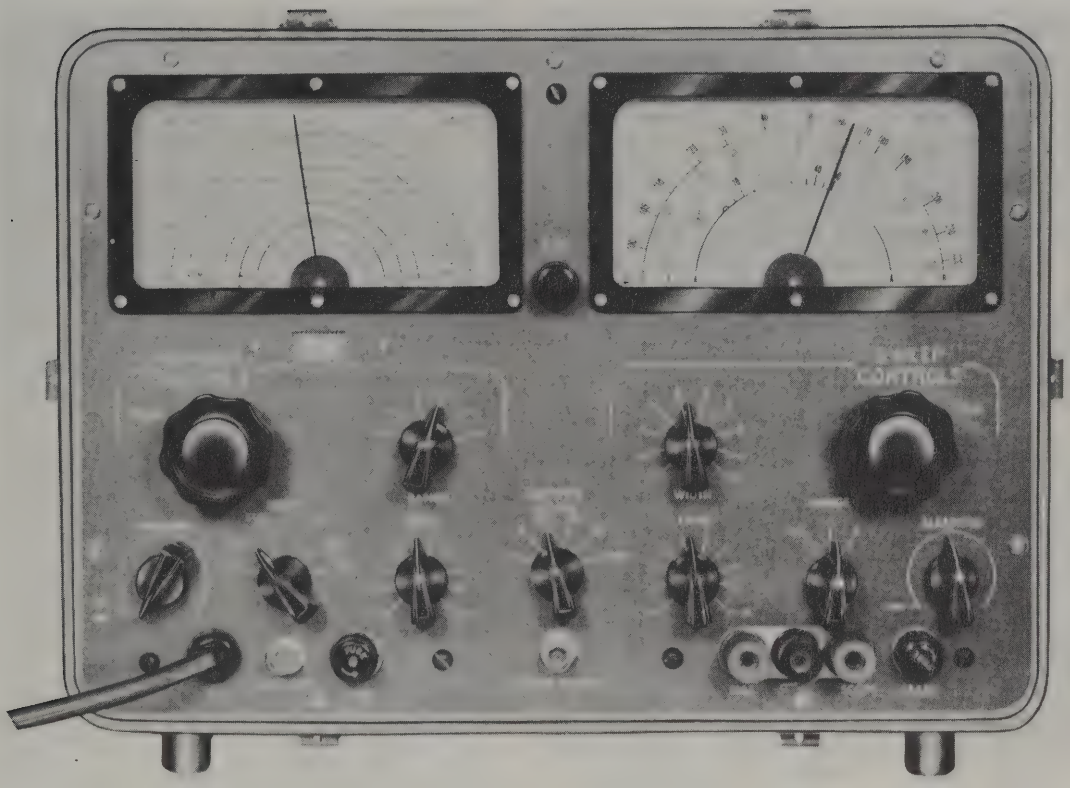

Figure 2-1. Location of Operating Controls

TABLE 2-1 (Continued)

Name	*Function*
MARKER RANGE	Knob-controlled, six-position rotary switch. In each position, switch selects range of frequencies over which marker oscillator can operate as follows: A position, 4 to 8 mc; B position, 8 to 16 mc; C position, 15 to 32 mc; D position, 30 to 60 mc; E position, 52 to 105 mc; and F position, 96 to 220 mc.
MARKER FREQ.	Knob-controlled, variable capacitor. Adjusts frequency of marker oscillator.
MARKER LEVEL	Knob-controlled potentiometer. Adjusts amplitude of marker signal.
OUTPUT LEVEL	Knob-controlled, six-position rotary switch. Adjusts amplitude of signal to MIXED OUTPUT jack. Calibrated to increase output in steps of 10 times

TABLE 2-1 (Continued)

Name	*Function*
OUTPUT LEVEL (Cont)	next lower level. Panel markings for control are 1, 10, 100, 1K, 10K, and HIGH. Output impedance for all positions except HIGH is constant at 50 ohms.
BLANKING	Knob-controlled switch and potentiometer. In OFF position, removes blanking voltage to SCOPE jack. When control is rotated clockwise from OFF position, applies blanking voltage to SCOPE jack for external oscilloscope. Further rotation varies amplitude of blanking voltage.
BIAS	Knob-controlled potentiometer. Varies voltage to BIAS jack from 0 to —12 volts.

2-3. SIGNAL OUTPUTS.

2-4. Table 2-2 lists the various output signals that can be obtained from the MKR. OUT jack and the MIXED OUTPUT jack, and shows the positions to which the MARKER SELECT and the SWEEP RANGE switches must be set in order to obtain each output. Paragraphs 2-5 through 2-12 provide instructions for obtaining various outputs.

TABLE 2-2.

SIGNAL OUTPUTS

Output Signal	*Position of MARKER SELECT Switch*	*Position of SWEEP RANGE Switch*
"MKR. OUT" JACK		
Marker signal (unmodulated r-f signal for test and alignment purposes)	MKR.	Any position
Crystal signal (unmodulated r-f signal for calibrating external equipment)	XTAL.	Any position
Calibration signal (beat signal for calibrating marker oscillator)	CAL.	Any position
Modulated marker signal (amplitude-modulated r-f signal for test and alignment purposes)	MOD. MKR.	Any position
Modulated crystal signal (amplitude-modulated r-f signal for calibrating external equipment)	MOD. XTAL.	Any position
"MIXED OUTPUT" JACK		
Sweep signal (frequency-modulated r-f signal for visual test and alignment purposes)	OFF	A or B
Marker signal (unmodulated r-f signal for test and alignment purposes)	MKR.	OFF
Crystal signal (unmodulated r-f signal for calibrating external equipment)	XTAL.	OFF

TABLE 2-2 (Continued)

Output Signal	*Position of MARKER SELECT Switch*	*Position of SWEEP RANGE Switch*
"MIXED OUTPUT" JACK (Cont)		
Calibration signal (beat signal for calibrating marker oscillator)	CAL.	OFF
Modulated marker signal (amplitude-modulated r-f signal for test and alignment purposes)	MOD. MKR.	OFF
Modulated crystal signal (amplitude-modulated r-f signal for calibrating external equipment)	MOD. XTAL.	OFF
Sweep signal mixed with marker signal (frequency-modulated r-f signal for visual test and alignment purposes, and unmodulated r-f signal for determining frequency of any point along response curve produced by sweep signal)	MKR.	A or B
Sweep signal mixed with crystal signal (frequency-modulated r-f signal mixed with unmodulated r-f signal)	XTAL.	A or B
Sweep signal mixed with calibration signal (frequency-modulated r-f signal mixed with beat signal)	CAL.	A or B
Sweep signal mixed with modulated marker signal (frequency-modulated r-f signal mixed with amplitude-modulated r-f signal)	MOD. MKR.	A or B
Sweep signal mixed with modulated crystal signal (frequency-modulated r-f signal mixed with amplitude-modulated r-f signal)	MOD. XTAL.	A or B

2-5. R-F OUTPUT.

2-6. This output of the signal generator can be used as a radio-frequency signal, with or without 600-cycle amplitude modulation. To obtain r-f output, set signal-generator controls as follows:

a. SWEEP RANGE switch to OFF position.

b. MARKER SELECT switch to MOD. MKR. position for modulated output, or to MKR. position for unmodulated output.

c. Rotate MARKER FREQ. control until desired frequency is indicated on dial. Set MARKER RANGE control to proper frequency band, as indicated by letter located at end of scale on which desired frequency appears.

d. Adjust output signal level by setting OUTPUT LEVEL control to obtain approximate signal level required, and making fine adjustment by turning MARKER LEVEL control.

Note

The r-f output from the marker oscillator can be calibrated against the crystal oscillator if desired. To calibrate the r-f output, turn MARKER SELECT switch to CAL. position, the MARKER LEVEL control to 10, the OUTPUT LEVEL control to HIGH, the SWEEP LEVEL control to 10, and connect output from MIXED OUTPUT jack of generator to vertical input terminals of oscilloscope. Strong beat notes will be observed at every 5 mc point up to 30 mc and at every 10 mc point thereafter. The 5 mc and 10 mc beat notes can be distinguished from extraneous beat notes by their greater amplitude.

The beat notes can be used as calibration check points on the marker oscillator dial. In use, set the MARKER FREQ. control to the calibrate frequency point nearest the desired frequency and then slowly turn MARKER FREQ. control for a zero beat. The difference between the dial reading and the calibration check point is the frequency error of the marker oscillator dial.

2-7. FM OUTPUT WITHOUT MARKER SIGNALS.

2-8. The output of the signal generator can be used as an FM sweep generator without any marker signals. To obtain FM output without marker signals, set the signal generator controls as follows:

a. SWEEP RANGE switch to A or B position, as required.

b. MARKER SELECT switch to OFF position.

c. SWEEP FREQ. control setting at which desired center frequency is indicated on calibrated dial.

d. SWEEP WIDTH control to position 6. Minimum to maximum deviation is obtained with control adjusted from position 0 to position 10; set control at position which gives desired amount of deviation. Positions 6 to 10 will be correct for wideband receivers, and positions 0 to 2 for FM receivers.

e. Adjust output signal level by setting OUTPUT LEVEL switch to obtain approximate signal level required, and making fine adjustment by turning SWEEP LEVEL control.

2-9. FM OUTPUT WITH MARKER SIGNALS.

2-10. The marker signal consists of a modulated or an unmodulated r-f signal (cw) which is combined with the FM sweep output to furnish a marker pip at some point along the response curve corresponding to the frequency to which the marker oscillator circuit is tuned. To obtain FM output with marker signals, proceed as follows:

a. Set generator controls as directed in paragraph 2-8, then set MARKER SELECT switch to MKR. or MOD. MKR. position, as desired.

b. Set MARKER RANGE switch and MARKER FREQ. control to correct frequency range. Adjust MARKER LEVEL control until a marker pip appears on response curve.

2-11. CRYSTAL OUTPUT.

2-12. An accurate, crystal-controlled output may be obtained from the signal generator. This output, which may be either modulated (mcw) or unmodulated (cw), will be at the frequency of the crystal used. Circuit constants are such that substitution of any crystal whose frequency is in the range of from 4 to 15 mc will provide output at that frequency without any further circuit adjustment. To obtain an unmodulated crystal output, set MARKER SELECT switch to XTAL. position. To obtain a modulated crystal output, set MARKER SELECT switch to MOD. XTAL. position.

2-13. EQUIPMENT CHECK BEFORE USE.

2-14. It is assumed throughout this section that the signal generator is in good operating condition, and that it has been correctly adjusted and inspected by maintenance personnel prior to its operation. Before applying power, make a visual check for any apparent damage or looseness of parts.

2-15. Before using the generator to align or adjust any of the internal controls of the receiver to be tested it is suggested that the operator make the following checks on the receiver.

a. Check all tubes in a tube checker. See that all tubes are replaced correctly.

b. Carry out any maintenance repairs, cleaning, and dusting as may be required.

c. Check to see that the tuning-capacitor plates are free from dust and dirt, and that the spacing between stator and rotor plates is uniform.

d. Check to see that all shields, plates, and panels are in place during alignment, as specified by the equipment manufacturer.

e. Always maintain all test equipment and equipment under test at the same ground potential; it is suggested that a metal-top bench be used.

f. Check the input power source for proper voltage.

g. Check all cable and connections to the equipment under test. Ground any shielded cabling.

h. Check the equipment for any missing parts (control knobs, charts, hardware, etc). Also check for damage, looseness, and seating of parts.

i. Operate both the equipment under test and the test equipment for a warm-up period of approximately 15 minutes before any alignment is made.

j. Check the over-all operating condition of the equipment to be tested as instructed in the equipment instruction manual.

2-16. STARTING PROCEDURE.

2-17. Start the signal generator in accordance with the following procedure.

a. Connect line cord to nearest 110-volt, 60-cycle service receptacle.

CAUTION

Do not connect this equipment to a d-c source. The a-c source must be between 110 and 120 volts at 60 cycles. Failure to observe these requirements may result in damage or incorrect indications.

b. Turn PHASING switch to "on" position, and allow signal generator to warm up for about 15 minutes before attempting any precise alignment.

c. Plug generator output cable into MIXED OUTPUT jack. The connections for the two output leads of the output cable to the various circuits of the equipment under test is explained in the relevant paragraphs for the various applications of the generator.

2-18. OPERATION.

2-19. The following paragraphs outline the step-by-step procedures for the operation of Generator, Sweep, AN/URM-75, to accomplish each function for which it is designed, and to obtain the best possible performance from the instrument. Figure 2-1 shows the location of the various controls mentioned in the procedure. This instrument was primarily designed to align and test Radio Receiver R-316/ARR-26; however, it can be used for other applications with other equipments. Suggested applications are given in the following paragraphs.

Note

When aligning a receiver, always refer to the relevant receiver instruction book for adjustment procedures recommended by the manufacturer.

2-20. SIGNAL GENERATOR AND OSCILLOSCOPE.

2-21. This signal generator, in conjunction with an associated oscilloscope used as an output indicator, produces a visual response curve by applying an FM signal, varying sinusoidally about a center frequency, at a 60-cycle rate, to the circuit being checked. The amount of frequency variation (deviation) about the center frequency is determined by the SWEEP WIDTH control. For a total deviation of 6 mc, the frequency varies above and below the center frequency by 3 mc. When this changing frequency is applied to the circuit under test, the instantaneous output amplitude is always proportional to the response of the circuit to the frequency at that instant. Thus, the original frequency-modulated input signal is changed in passing through the amplifier, so that the output signal from the amplifier now consists of an FM signal which is also amplitude-modulated. Since, for equal deviations, the positive and negative portions of the envelope are symmetrical, it is necessary to observe one side of the envelope only. Since the signal is also varying at an r-f rate, it cannot be seen on the oscilloscope without first being detected. The composite signal is therefore detected by either the second detector or the discriminator of the receiver, or, in special instances, by a high-frequency probe (oscilloscope input leads). After detection, only the modulation remains, and this appears on the oscilloscope in the form of the response curve of the amplifier. Since the FM signal is swept at a 60-cycle rate, the presentation appears as a continuous curve, because of the persistence of vision. It should be noted that the detector polarity determines whether a positive or negative output occurs, so that the response curve will appear inverted if the output is of negative polarity. However, the response curve may be used in whichever position it appears at the output of the detector.

2-22. Since a 60-cycle voltage is available from the power mains, the FM generator is swept at this frequency, permitting the use of the 60-cycle voltage available at the SCOPE jack for horizontal deflection of the external oscilloscope, thus providing a synchronized sweep. Since both the FM output of the generator and the horizontal-sweep voltage of the oscilloscope are varying sinusoidally, at the same rate, the presentation appears as though a linear sweep were used. However, the input voltage must be of the proper phase to produce a straight-line indication. The proper phasing is accomplished by the phasing network in the generator, and it is controlled by the PHASING potentiometer.

2-23. It is important to remember that a response curve can be more easily checked when it covers a large portion, rather than a small portion, of the oscilloscope screen; therefore, the SWEEP WIDTH control should be operated at a position which produces only enough deviation to accommodate the pass band of the circuit under test. It is poor practice to operate the generator at maximum deviation at all times, or to use a sweep width greater than required, except for some special objective. As a general rule, FM circuits should be operated with about 1-mc deviation. Since the operator wishes to know the approximate amount of frequency deviation, the SWEEP WIDTH control should be calibrated (refer to the Handbook of Service Instructions).

2-24. While the response curve shows the frequency discrimination of the circuit under test, some means of determining the actual frequency at any definite point along the curve is necessary. This could be accomplished, in some instances, by use of an absorption-type wave trap, which causes a reduction of amplitude at the point of resonance, placing a notch in the curve. In this FM signal generator, however, a separate marker generator is used to furnish a c-w signal which is combined with the

FM sweep output signal. At the point on the response curve corresponding to the frequency to which the marker generator is tuned, a pip is produced which is the result of the beat between the marker oscillator and the sweep oscillator at that frequency. It must be noted that the pip, if too strong in amplitude, will have a tendency to change the response curve somewhat; therefore, it is recommended that the output of the marker oscillator be kept as low as possible at all times. In order to ensure that the marker oscillator is at its exact selected frequency, the marker frequency should be calibrated at regular intervals in accordance with the procedure given in the Handbook of Service Instructions.

2-25. The general connections for the signal generator and the oscilloscope are as follows: Connect the cable from the MIXED OUTPUT jack of the generator between the circuit under test and ground, connect oscilloscope vertical-deflection terminals as required, and connect the horizontal-deflection terminals to the SCOPE jack and ground jack. The oscilloscope must be centered, focused, and adjusted to obtain proper screen presentation.

2-26. The MKR. OUT and MIXED OUTPUT jacks of the signal generator are each provided with a 0.01-μf coupling capacitor in series with the jack. Therefore, when aligning, testing, etc., the signal generator may be connected directly to the circuit under test without concern for damage resulting from voltages present at the injection points.

2-27. It should be remembered that the PHASING and BLANKING controls of the generator must be adjusted properly to present a steady, single-trace pattern on the oscilloscope screen. Figure 2-2 shows settings of these controls for a typical discriminator curve. First, with the BLANKING control in the OFF position, adjust the PHASING control to obtain a single image, then turn the BLANKING control clockwise until a single image with base line appears. Adjust the SWEEP WIDTH control to obtain sufficient deviation. Set the

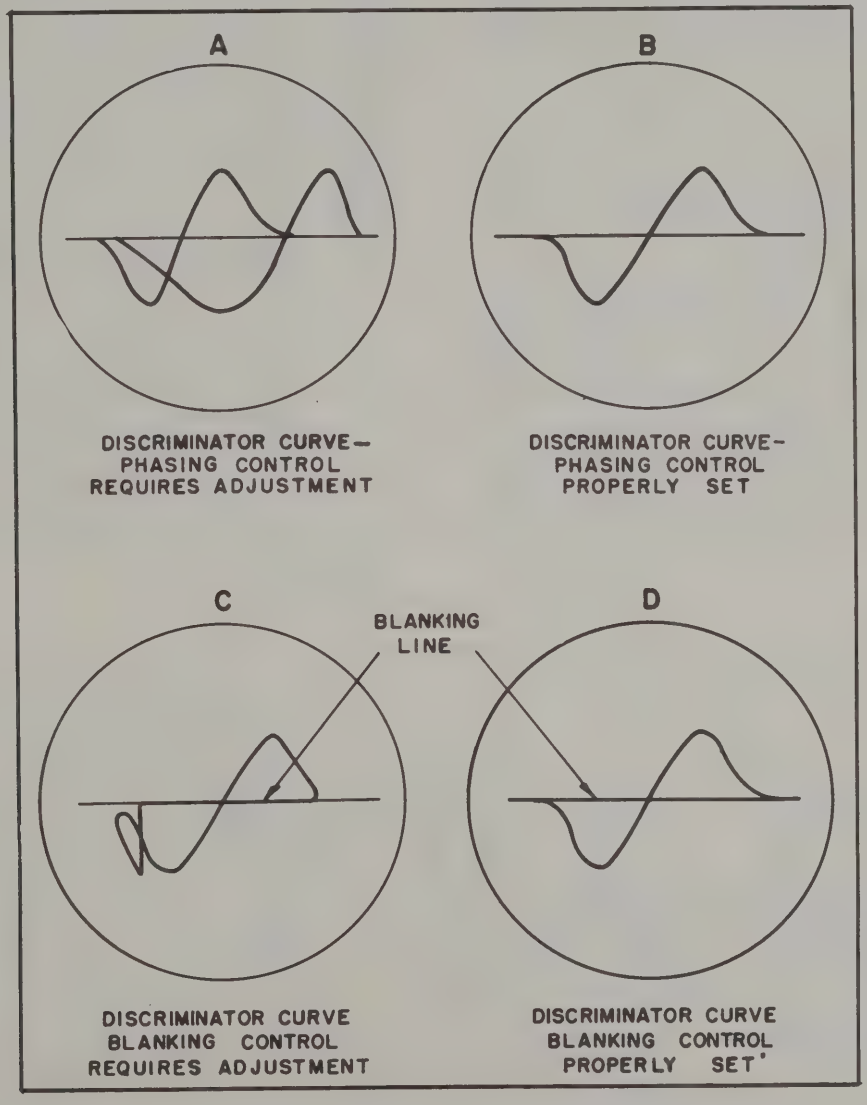

Figure 2-2. Control Settings for Typical Discriminator Curve

horizontal and vertical gain controls (on oscilloscope) to keep the image on the scope screen at a convenient size. As a general rule, changes in symmetry may be more easily determined when the response curve is larger than when it is small. Once proper sweep setting is obtained, blanking must be removed, and the PHASING control reset for curve coincidence.

2-28. When using the marker pip to locate a frequency on the response curve, if the marker pip should appear too small, even with the MARKER LEVEL control set at position 10 (maximum), increase the vertical gain of the oscilloscope. Inasmuch as this adjustment will also increase the amplitude of the response curve, turn the OUTPUT LEVEL switch to the position which brings the screen presentation back to its original size. To make the marker pip as small as possible with respect to the response curve, turn the MARKER LEVEL control to position 1 (minimum), and set the OUTPUT LEVEL switch to give the best over-all attenuation. If the marker pip still appears too large, set the MARKER FREQ. control to one-half the desired frequency which will be the subharmonic of the dial indication.

2-29. ALIGNMENT OF FM RECEIVER.

2-30. There are two basic methods of aligning an FM receiver; FM alignment with an FM signal, and FM alignment with an AM signal. Generator, Sweep, SG-93/URM-75, provides the operator with facilities for using either of the two methods.

2-31. When aligning or testing an FM receiver with an FM signal, an oscilloscope with a high-impedance input is required as the output indicator to present a visual response curve. As this signal generator provides the proper output and controls to be used in conjunction with an oscilloscope, it is recommended that the FM signal method be used to align all FM receivers (unless otherwise specified by the instruction manual for the FM receiver), and therefore, this method will be described in following paragraphs.

Note

Always use nonmetallic tools for alignment purposes.

2-32. As this signal generator is designed with sufficient signal output and sufficient sweep deviation, it is not necessary, in most cases, to align the i-f stages before aligning the discriminator; instead, the discriminator may be aligned first, and the rest of the receiver aligned to the discriminator.

2-33. Before starting the alignment procedure, set all receiver controls for normal operation, and allow receiver and test equipment to warm up for about 15 minutes. The generator and the oscilloscope, which are used in conjunction in the alignment procedure, must be connected and adjusted properly (refer to paragraph 2-25).

2-34. There are three general types of FM detectors used in FM receivers; the limiter, the ratio, and the advanced.

2-35. LIMITER-TYPE DETECTOR. To align a limiter-type detector, proceed as follows:

a. Referring to figure 2-3, connect cable from MIXED OUTPUT jack of signal generator directly between test point B and ground, and connect oscilloscope vertical-deflection terminals between test point A and ground.

b. Set MARKER SELECT switch to OFF position, set SWEEP FREQ. control to desired center frequency, and set SWEEP RANGE switch to position A.

c. Set SWEEP WIDTH control to obtain approximately 200 kc total deviation, and adjust discriminator-primary capacitor C2 to obtain a curve of maximum amplitude; the curve will appear somewhat S-shaped if the secondary is not too far detuned. It will be necessary to keep the OUTPUT LEVEL switch and SWEEP LEVEL control set for an output below that at which limiting occurs.

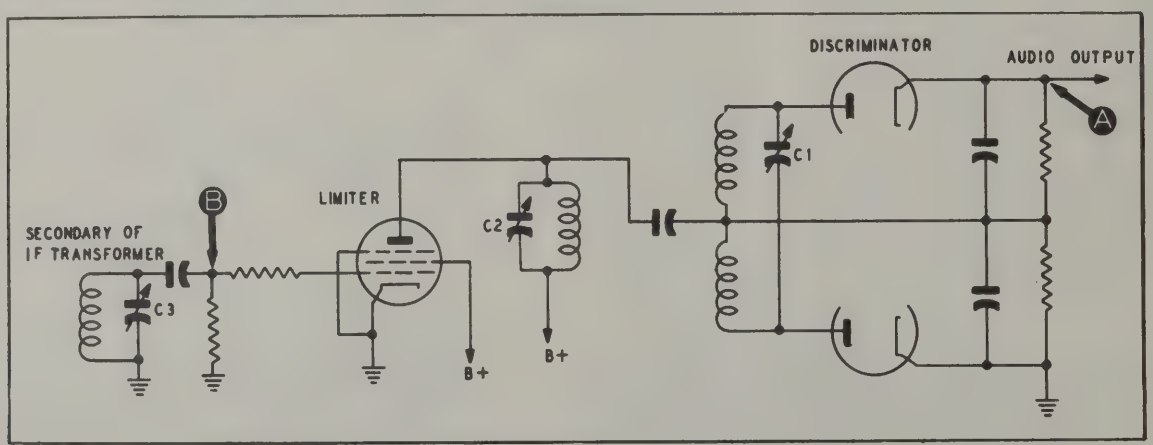

Figure 2-3. Alignment of Limiter Type Detector

Note

The PHASING and BLANKING controls will usually have to be adjusted to obtain a single trace line on the oscilloscope (refer to paragraph 2-27).

d. Adjust discriminator-secondary trimmer capacitor C1 to obtain an S-shaped symmetrical response curve set to exact center frequency (refer to paragraph 2-53).

e. Retune C2, and if possible, obtain a symmetrical response curve with greater amplitude than that obtained in step d.

f. Connect cable from MIXED OUTPUT jack to grid of last i-f stage preceding limiter stage, and adjust trimmer C3 to obtain a symmetrical response curve of maximum amplitude.

g. Connect cable from MIXED OUTPUT jack between grid of mixer tube and ground, and if output can be kept below receiver limiting point, adjust each i-f secondary and primary, in turn, proceeding from the last i-f stage back to the first i-f stage, to obtain a symmetrical response curve of maximum amplitude. If limiting occurs, that is, if there is no change in amplitude as trimmers are adjusted, connect output of signal generator between test point B and ground, and adjust each i-f stage as before. Then, when C3 is reached, connect oscilloscope input leads to test point A, move output cable of signal generator to grid of stage preceding C3, and adjust C3 and discriminator as directed in steps a through e above.

Note

As each i-f trimmer is adjusted, adjust the SWEEP LEVEL control and the OUTPUT LEVEL switch of the signal generator, and the vertical gain control of the oscilloscope, to keep the pattern within the limits of the screen.

h. Align i-f stages as directed in paragraph 2-61.

2-36. RATIO-TYPE DETECTOR. To align a ratio-type detector, proceed as follows:

a. Referring to figure 2-4, connect cable from MIXED OUTPUT jack of signal generator directly between test point B and ground, and connect oscilloscope vertical-deflection terminals between test point A and ground.

b. Set MARKER SELECT switch to OFF position, set SWEEP FREQ. control to desired center frequency, and set SWEEP RANGE switch to position A.

c. Set SWEEP WIDTH control to obtain approximately 600 kc deviation, and adjust discriminator-primary trimmer capacitor C2 to obtain a response curve of maximum amplitude; the curve will be S-shaped if the secondary trimmer capacitor is near the proper adjustment.

d. Adjust discriminator-secondary trimmer capacitor C1 to obtain an S-shaped symmetrical response curve set to exact center frequency (refer to paragraph 2-53).

e. Remove output cable from test point B, and advance and reconnect it one stage toward the mixer, tuning the secondary and then the primary of the last i-f transformer to obtain a symmetrical S-shaped response curve of greater amplitude than that obtained in step d.

f. Proceed to adjust each i-f stage, in turn, until the mixer is reached, adjusting SWEEP LEVEL control, OUTPUT LEVEL switch, and vertical gain control of oscilloscope to keep pattern within limits of scope screen.

g. Align the i-f stages as directed in paragraph 2-61.

2-37. ADVANCED FM DETECTOR. To align an advanced FM detector, proceed as follows:

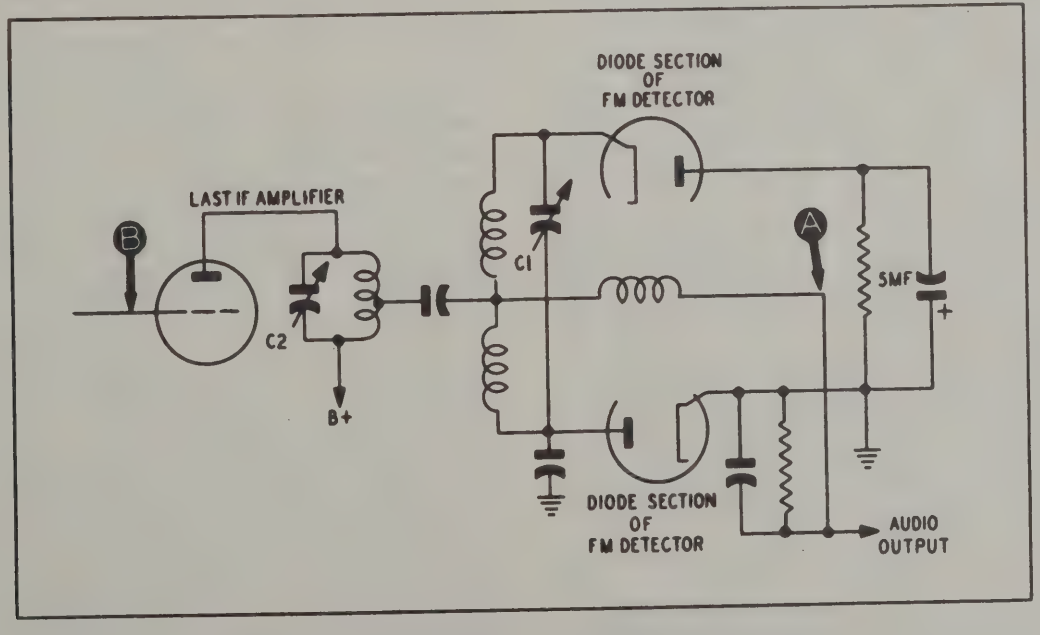

Figure 2-4. Alignment of Ratio Type Detector

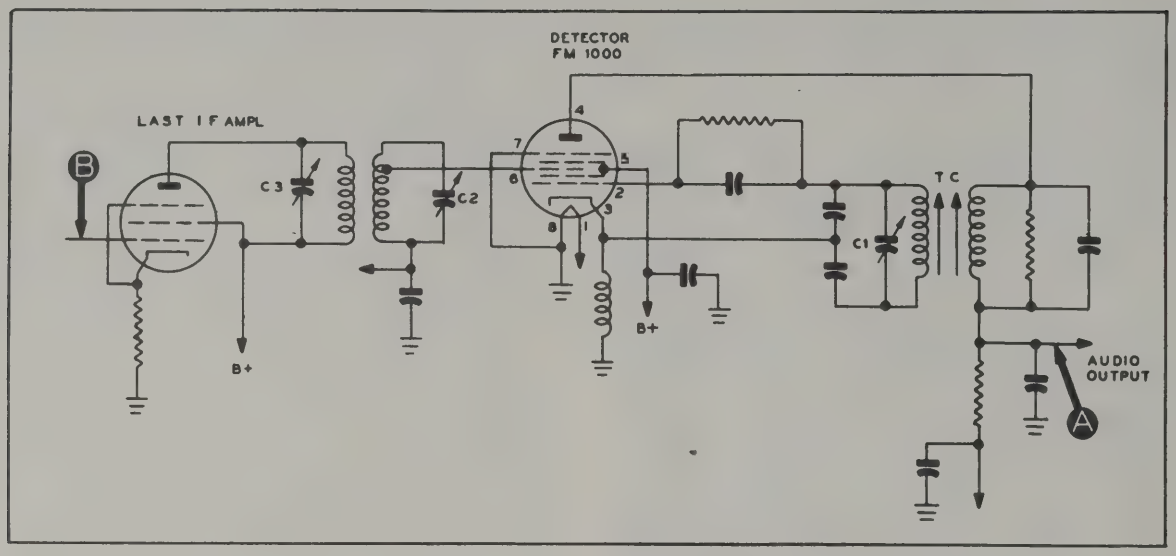

Figure 2-5. Alignment of Advanced FM Detector

Note

This type of FM detector requires that the i-f stages be adjusted first (refer to paragraph 2-61), then the detector is adjusted to the i-f center frequency.

a. Referring to figure 2-5, connect cable from MIXED OUTPUT jack of signal generator directly between test point B and ground, and connect oscilloscope vertical-deflection terminals between test point A and ground.

b. Set SWEEP FREQ. control to center of i-f frequency, set SWEEP RANGE switch to position A, and set MARKER SELECT switch to MKR. position.

c. Short-circuit pin 2 of FM 1000 tube to ground, to render oscillator inoperative. Set the SWEEP WIDTH control to obtain about 200 kc total deviation. Adjust SWEEP LEVEL control, OUTPUT LEVEL switch, and vertical gain control of oscilloscope to obtain a pattern of desired height on scope screen.

d. Adjust last i-f secondary trimmer C2 to obtain a symmetrical i-f response curve of maximum amplitude, and then adjust last i-f primary trimmer C3 to obtain a similar response. Connect signal-generator output cable to grid of preceding i-f stage, and adjust secondary and primary trimmers, in turn. Again move output cable to preceding stage, and adjust each i-f transformer, in turn until all i-f transformers have been aligned.

e. Remove short-circuit from pin 2 of oscillator tube, and adjust trimmer capacitor C1 to obtain a hooked curve.

Note

It will be necessary to decrease the receiver input to threshold value to secure the hooked curve. Be certain that the curve is symmetrical about the center.

f. Increase output of signal generator until hooked curve just straightens out and becomes an almost straight line, then adjust secondary tuning core TC (see figure 2-5) to obtain a straight line.

Note

If the scope pattern is not observed directly from the front of the oscilloscope, it is possible to adjust for what appears to be a straight line, which, when checked with a straightedge, is found to be bowed. Adjust the PHASING and BLANKING controls to obtain a single trace line on the oscilloscope, as instructed in paragraph 2-27.

2-38. I-F STAGES. The instruction manual for the FM receiver should be consulted for procedure, recommended by the manufacturer. For a general procedure, proceed as follows:

a. Connect oscilloscope vertical-deflection terminals between detector output and ground. Connect cable from MIXED OUTPUT jack of signal generator directly to i-f stages, as directed for the following types of detectors: for the limiter-type detector, connect cable to grid of last i-f amplifier preceding the limiter; for the ratio detector, connect cable to grid of i-f amplifier preceding last i-f amplifier; for the advanced detector, connect cable to grid of last i-f amplifier.

b. Set MARKER SELECT switch to OFF position, and set SWEEP WIDTH control to obtain at least 200 kc total deviation. Set signal generator to i-f band, by use of SWEEP FREQ. control. If the limiter or ratio-type of detector is used, adjust detector as instructed in paragraphs 2-42 or 2-43, respectively. If the advanced FM detector is used, tune the secondary of the last i-f transformer to obtain a broad curve, covering at least 200 kc total deviation.

c. Connect signal-generator output cable to preceding i-f amplifier. Adjust secondary and primary trimmers, in turn, to obtain a curve similar to the one obtained in step b.

Note

If any adjustment increases the height of the curve on the oscilloscope, reduce the vertical gain.

d. Continue the procedure of step c until the first i-f stage is aligned.

Note

The advanced FM detector, if used, will require alignment at this point (refer to paragraph 2-44).

2-39. R-F AND OSCILLATOR STAGES. The instruction manual for the FM receiver should be consulted for the procedures recommended by the manufacturer. For a general procedure to align the r-f and oscillator stages, proceed as follows:

a. Connect cable from MIXED OUTPUT jack of signal generator to antenna terminals of FM receiver, and connect oscilloscope vertical-deflection terminals between detector output and ground.

b. Set MARKER SELECT switch to OFF position, set SWEEP FREQ. control and FM receiver dial to middle of FM band of receiver, and set SWEEP WIDTH control to obtain a total deviation of approximately 200 kc.

c. Adjust short trimmer of oscillator stage to obtain maximum output.

d. Adjust short trimmer of mixer grid to obtain maximum output. If an r-f stage is employed, also adjust its short trimmer to obtain maximum output.

e. Repeat step d until no further improvement is noted.

f. Check tuning with various frequency settings of receiver and signal generator.

2-40. RECEIVER TESTING.

2-41. RELATIVE RECEIVER SENSITIVITY. For detailed receiver-testing instructions, refer to the instruction manual for the receiver. The following procedure is general; it utilizes a "standard" receiver, and the receiver under test is measured against this "standard" receiver. Both receivers must be adjusted to operate under the same conditions. To determine relative receiver sensitivity, proceed as follows:

a. Connect cable from MIXED OUTPUT jack of signal generator to antenna terminals of "standard" receiver. For an FM receiver, connect oscilloscope vertical-deflection terminals between detector output and ground; for an AM receiver, connect an output meter to audio output stage (plate of output tube) or to voice coil of speaker.

b. Disable a-g-c circuit, if used, by removing a-g-c tube or grounding a-g-c bus line.

c. For an FM receiver set signal-generator controls as directed in paragraph 2-7; for an AM receiver, set generator controls as directed in paragraph 2-5.

d. Set vertical gain control of oscilloscope to obtain a 2-volt, peak-to-peak, discriminator-response indication (adjust PHASING control to obtain a single image, and BLANKING control to obtain a single image with a base line). Note indication of output meter, and note settings of OUTPUT LEVEL switch and SWEEP LEVEL (MARKER LEVEL for AM receiver) control.

e. Replace "standard" receiver with receiver under test, and any changes in settings of OUTPUT LEVEL switch and SWEEP LEVEL (MARKER LEVEL for AM receiver) control necessary to produce same output at same frequency as compared with "standard" receiver settings indicates relative receiver over-all sensitivity.

2-42. APPROXIMATE STAGE GAIN (RF, IF, VIDEO, OR AUDIO). For detailed instructions for the determination of stage gain, refer to the instruction manual for the receiver. To obtain a general approximation of the stage gain, proceed as follows:

a. Connect cable from MIXED OUTPUT jack of signal generator to stage ahead of receiver detector. For an FM receiver, connect oscilloscope vertical-deflection terminals between detector output and ground; for an AM receiver, connect an output meter to audio output stage (plate of output tube) or to voice coil of speaker.

b. For an AM receiver, set signal generator controls as directed in paragraph 2-5; for an FM receiver, set generator controls as directed in paragraph 2-7.

c. On the oscilloscope, select an arbitrary amplitude as reference, such as 10 cross-hatch divisions, set OUTPUT LEVEL switch and adjust SWEEP LEVEL control so that, with vertical gain control of oscilloscope set at some low figure, the arbitrary reference amplitude is obtained. Do not disturb setting of vertical gain control. On the output meter, select an arbitrary indication as a reference, such as an indication on the low scale, and set OUTPUT LEVEL switch and MARKER LEVEL controls to obtain the arbitrary reference indication.

d. Proceed from second detector toward antenna, connecting signal generator output cable to grid of each stage, in turn, and note setting of OUTPUT LEVEL switch and SWEEP LEVEL (MARKER LEVEL for AM receivers) control required to produce the arbitrary reference amplitude. The amount of attenuation necessary to produce the arbitrary reference amplitude is a relative measure of the gain of the stage being checked.

Note

The MARKER FREQ. (for AM receiver) or the SWEEP FREQ. (for FM receiver) control must be set to the frequency of the stages being tested. The SWEEP WIDTH control must be set for the proper deviation.

2-43. R-F, I-F, AND VIDEO STAGES CONTINUITY. The following procedure provides a method of checking circuit continuity. This method may be used in trouble-shooting to check an entire circuit or make a stage-by-stage check. To check continuity of r-f, i-f, and video stages, proceed as follows:

a. Set signal generator controls as directed in paragraph 2-5, using 600-cycle amplitude modulation.

b. Connect oscilloscope vertical-deflection terminals between receiver detector output and ground. Connect output cable from MIXED OUTPUT jack to each i-f stage, in turn, progressing from detector toward receiver input. A 600-cycle sine-wave pattern should appear on the oscilloscope screen if the stage is functioning. The vertical gain control of the oscilloscope may need adjusting at each stage to maintain the pattern within view on the screen. The MARKER FREQ. control on the signal generator should be set for the proper r-f or i-f frequency, depending upon the stage being checked.

c. The lack of response of an FM receiver could also indicate loss of continuity; therefore, an FM output without marker signals can be used. To use this method, set signal-generator controls as directed in paragraph 2-7, and use the procedure outlined in step b above. An FM response curve should appear on the oscilloscope screen.

2-44. R-F AND MIXER RESPONSE. The following procedure provides a method of checking the r-f and mixer response; proceed as follows:

a. Connect oscilloscope vertical-deflection terminals to mixer-plate decoupling filter. If a decoupling network is not provided, connect oscilloscope through a high-frequency probe to plate of mixer. Connect output cable from MIXED OUTPUT jack to antenna connection of FM receiver. If the input of the FM receiver is other than 50 ohms, the signal generator will have to be connected through an appropriate matching network. Remove first i-f amplifier tube.

b. Set signal-generator controls as directed in paragraph 2-9. Set OUTPUT LEVEL switch and SWEEP LEVEL control to obtain desired pattern height, with vertical gain control of oscilloscope set to a "low" position.

c. While observing the response curve on the oscilloscope, vary marker pips by adjusting MARKER FREQ. control to determine response curve cut-off points. Note that the MARKER LEVEL control determines the amplitude of the marker pips.

2-45. DISCRIMINATOR CENTER FREQUENCY. To set a discriminator to its exact center frequency, the recommended procedure consists of applying a modulated r-f signal of the exact center frequency to the discriminator circuit, then adjusting the secondary of the discriminator transformer until the modulation disappears, indicating that the output of discriminator is adjusted to zero voltage at the center frequency.

2-46. An alternate method is to set a marker pip on the discriminator response curve to the crossover point at the discriminator center frequency. This method is not so effective as that just described, because of its inaccuracy; the marker disappears at the center frequency, and while adjusting, it is difficult to determine the exact points at which the marker pip will disappear and reappear, resulting in a possible inaccurate fix of the center frequency.

2-47. To adjust a discriminator to center frequency by the recommended method, proceed as follows:

a. Connect oscilloscope vertical-deflection terminals between receiver detector output and ground. Connect cable from MIXED OUTPUT jack of signal generator to grid of last i-f tube.

b. Set MARKER FREQ. control, MARKER RANGE switch, and SWEEP FREQ. control to obtain exact center frequency of discriminator. Set SWEEP RANGE switch to position A, set MARKER SELECT switch to MOD. MKR. position, and set SWEEP WIDTH control to position 1. On the oscilloscope, adjust horizontal gain control to obtain a horizontal trace of approximately two inches. Set OUTPUT LEVEL switch and SWEEP LEVEL control to obtain a pattern of approximately one inch, with the vertical gain control of the oscilloscope set to a "low" position. Set MARKER LEVEL control to position 10.

Note

In this adjustment, the setting of the MARKER LEVEL control is critical. If the control is set too high, the center frequency will be hard to locate.

c. Two types of presentation may be obtained on the oscilloscope; first, a typical S-shaped discriminator curve, if the discriminator-secondary trimmer capacitor is correctly adjusted to the exact center frequency; and second, an S-shaped curve, plus the 600-cycle modulation along the base line (see curve A of figure 2-6), if the secondary trimmer capacitor is not adjusted to the exact center frequency, but close to it. Regardless of which pattern is obtained, adjust the discriminator-secondary trimmer capacitor until the second pattern is shown, then slowly vary the trimmer capacitor clockwise, and then counterclockwise, until the pattern disappears, and then reappears, with a further movement of the trimmer capacitor. Set the trimmer capacitor at the null point at which the 600-cycle portion disappears.

2-48. To adjust the discriminator to center frequency by the alternate method, proceed as follows:

a. Connect equipment and set all controls as directed in paragraph 2-20 except set MARKER SELECT switch to MKR. position. Set MARKER FREQ. control slightly off center frequency, and adjust controls until marker pip is visible on discriminator response curve (see curve B of figure 2-6). Then set MARKER FREQ. control to obtain exact center frequency, and set discriminator-secondary trimmer capacitor until marker pip disappears at crossover point in center of response curve. The discriminator is now tuned to the exact center frequency.

Note

It is suggested that the blanking circuit of the generator be used to help determine the crossover point of the response curve. To use the blanking circuit, first adjust the PHASING control to obtain a single pattern, then turn the BLANKING control clockwise until the single pattern appears with a horizontal line through its full width. Turn the SWEEP FREQ. control slightly to center the pattern on the oscilloscope screen.

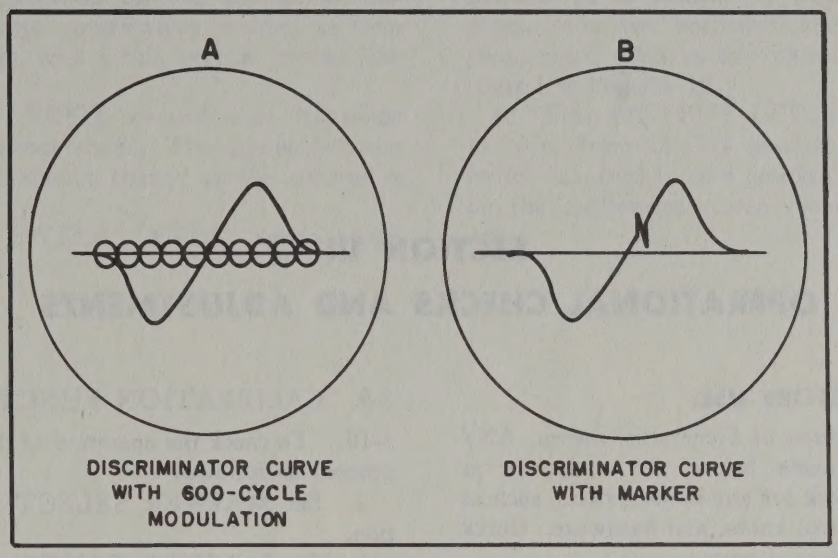

Figure 2-6. Discriminator Response Curves

2-49. ALIGNMENT OF RADIO RECEIVER R-316/ARR-26.

2-50. Generator, Sweep, AN/URM-75 was designed to align Radio Receiver R-316/ARR-26. To perform the alignment, follow the procedure in Section V of the Handbook of Maintenance Instructions for Radio Receiving Set AN/ARR-26. Generator, Sweep, AN/URM-75 should be substituted for the signal generator recommended in the Handbook of Maintenance Instructions, and the applicable operating instructions for Generator, Sweep, AN/URM-75 should be followed.

2-51. OPERATIONAL PRECAUTIONS.

2-52. The precautions given in the following paragraphs must be observed by the operator of Generator, Sweep, AN/URM-75. Failure to observe these precautions may cause damage to the equipment, or may produce false and misleading meter indications.

2-53. ABNORMAL LINE VOLTAGES. Generator, Sweep, AN/URM-75 has been designed to operate satisfactorily with an a-c line voltage input of from 110 to 120 volts at 60 cycles. Within the limits of the specified operating line voltage, the output frequency of the generator will be within one-half of one per cent of the dial calibration. Above and below the input limits of the specified a-c line voltage, the output frequency accuracy will deviate greatly from the dial calibration.

2-54. INSUFFICIENT WARM-UP PERIOD. Before attempting any alignment or test described in this handbook, it is essential that the signal generator and any other equipment involved be allowed a warm-up period of at least 15 minutes. This permits all frequency-controlling parts to become stabilized at the normal operating temperatures of the equipment. Failure to allow sufficient time for a warm-up will result in frequency-drift in both the signal generator and the equipment being tested, and will bring about misalignment of critical tuned circuits.

SECTION III
OPERATIONAL CHECKS AND ADJUSTMENTS

3-1. INSPECTION BEFORE USE.

3-2. A thorough inspection of Generator, Sweep, AN/URM-75, should be made before the equipment is placed in operation. Check for any missing parts, such as cables, detector box, control knobs, and hardware. Check for any damage or looseness of parts.

3-3. PRELIMINARY CONNECTIONS AND ADJUSTMENTS.

3-4. In order to perform the operational checks on the signal generator, an oscilloscope with a high-impedance input must be connected to the output of the generator, and the generator controls must be preadjusted. Proceed as follows:

a. Connect vertical-input terminals of oscilloscope to MIXED OUTPUT jack of signal generator.

b. Connect horizontal-input terminals of oscilloscope between SCOPE jack and ground jack of signal generator.

c. Turn off internal sweep generator of oscilloscope.

d. Turn PHASING control to PWR. OFF position.

e. Plug line cord into 110 to 120-volt, 60-cycle receptacle.

f. Turn PHASING control to center of its range.

g. Turn BLANKING control to OFF position.

h. Set MARKER RANGE switch to position A.

i. Set SWEEP RANGE switch to OFF position.

j. Turn SWEEP WIDTH control to position 1.

k. Set MARKER SELECT switch to OFF position.

l. Turn MARKER LEVEL control to position 10.

m. Set OUTPUT LEVEL switch to HIGH position.

n. Turn SWEEP LEVEL control to position 10.

3-5. ELECTRICAL CHECKS AND ADJUSTMENTS.

3-6. The operator can check the operation of the equipment by making the checks and adjustments given in the following paragraphs. After each check is made, return all controls to the positions stated in paragraph 3-4. The controls will then be set up for the next check.

3-7. PHASING FUNCTION.

3-8. To check the operation of the phasing function, adjust the PHASING control over its entire range while observing the oscilloscope. The pattern on the oscilloscope should change from an elliptical pattern to a single trace, and then open up again as the control is advanced.

3-9. CALIBRATION FUNCTION.

3-10. To check the operation of the calibration function, proceed as follows:

a. Set MARKER SELECT switch to CAL. position.

b. Set MARKER RANGE switch to position A.

c. Turn MARKER FREQ. control over its entire range while observing marker dial and oscilloscope screen. Zero-beat patterns should appear on the oscilloscope screen at each 10-mc point and at some 5-mc points of the marker dial.

d. Set MARKER RANGE switch to each of the other five positions, in turn, and at each position, repeat step c. The zero-beat patterns should appear at each 10-mc point as in step c.

3-11. SWEEP FUNCTION.

3-12. To check the operation of the sweep function, proceed as follows:

a. Set SWEEP RANGE switch to position A.

b. Set MARKER RANGE switch to position C.

c. Turn SWEEP FREQ. control until sweep dial indicates approximately 25 mc.

d. Turn MARKER FREQ. control until marker dial indicates same frequency as indicated on sweep dial. A zero-beat pattern should appear on the oscilloscope screen when the marker frequency and the sweep-oscillator frequency are equal.

e. Set SWEEP RANGE switch to position B.

f. Set MARKER RANGE switch to position F.

g. Turn SWEEP FREQ. control until sweep dial indicates approximately 135 mc.

h. Turn MARKER FREQ. control until marker dial indicates same frequency as indicated on sweep dial. A zero-beat pattern should appear on the oscilloscope screen when the marker frequency and the sweep-oscillator frequency are equal.

3-13. BLANKING AND ATTENUATION FUNCTIONS.

3-14. To check the operation of the blanking and attenuation functions, proceed as follows:

a. Set SWEEP RANGE switch to position B. Insert detector box and connect leads to vertical input of oscilloscope. Turn BLANKING control to OFF and adjust PHASING control until a single trace is obtained.

b. Turn on BLANKING control, and adjust this control until oscilloscope presentation consists of two bright horizontal traces, with a thin vertical retrace line at each end.

c. Turn SWEEP FREQ. control over its range while observing oscilloscope screen. The spacing between the two bright traces should change as the control is rotated.

d. Slowly rotate SWEEP LEVEL control from position 10 to position 0, while observing oscilloscope screen. The two horizontal traces should gradually approach each other as the control is rotated. Return the control to position 10.

e. Turn OUTPUT LEVEL switch to each position, in turn, from HIGH position to position 1. As the switch is turned to each position, the two horizontal lines on the oscilloscope screen should move closer to each other.

SECTION IV
EMERGENCY OPERATION AND REPAIR

4-1. EMERGENCY OPERATION.

4-2. If certain portions of the equipment should fail during operation, it may still be possible to operate the equipment in a limited manner. Operation under such conditions should not be continued indefinitely, and the maintenance activity should make repairs as soon as possible.

WARNING

Operation of this equipment involves the use of high voltages which are dangerous to life. Operating personnel must at all times observe safety precautions. Under certain conditions, dangerous potentials may exist in circuits, even with the power control in the off position, because of charges retained by capacitors. To prevent casualties, always discharge and ground circuits before working on the equipment.

4-3. If FM Signal Generator, AN/URM-75, should fail in such a manner that only one section is defective, the other sections can be used to provide their normal functions. If the FM sweep oscillator should fail, for example, the marker oscillator can still be used to supply modulated or unmodulated r-f signals, and the equipment can be used as an AM signal generator. The crystal oscillator can still be used to calibrate external equipment. Moreover, if the nature of the defect is such that the FM sweep oscillator is inoperative on only one band, the generator can still be used on the other band, provided that the equipment being aligned or checked requires a sweep signal within the frequency range of the operative band. The procedure for such limited operation is the same as that described in Section II for normal operation.

4-4. REPLACEMENT OF ELECTRON TUBES AND FUSES.

4-5. LOCATION OF ELECTRON TUBES AND FUSES.

4-6. The electron tubes in FM Signal Generator AN/URM-75 are located on the chassis, and are made accessible by removing the dust cover. A 1-ampere fuse and a spare fuse are mounted on the front panel of the equipment.

4-7. ELECTRON-TUBE REPLACEMENT.

4-8. To remove any tube from the signal generator, grasp the tube and pull straight out. If the tube is shielded, remove the shield first by pressing in and then by turning clockwise. Always replace a tube with one of the same type.

WARNING

Turn off power to equipment before removing or replacing tubes, in order to prevent injury from high voltage or high temperature.

4-9. FUSE REPLACEMENT.

4-10. If the equipment is dead and the dial lamps fail to light, the trouble may be an open fuse in the lead to the primary a-c supply. To remove the fuse, unscrew the cap over the LINE marking on the panel, and remove the fuse from the cap. A spare fuse is located under the cap above the SPARE marking on the panel. If the LINE fuse is open, insert the spare into the LINE cap, and screw the cap into the fuse holder.